Name:____ Date:____________________

Polynomial Operations SOLUTION (version 105)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 2x^5 + 7x^3 + 10x^2 + 4x - 8$$

$$q(x) = -8x^5 + 9x^4 - 7x^2 - 6x + 5$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (2)x^5 + (0)x^4 + (7)x^3 + (10)x^2 + (4)x^1 + (-8)x^0 \\
q(x) &= (-8)x^5 + (9)x^4 + (0)x^3 + (-7)x^2 + (-6)x^1 + (5)x^0 \\
p(x) + q(x) &= (-6)x^5 + (9)x^4 + (7)x^3 + (3)x^2 + (-2)x^1 + (-3)x^0 \\
p(x) + q(x) &= -6x^5 + 9x^4 + 7x^3 + 3x^2 - 2x - 3
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 4x^2 - 3x + 7$$

$$b(x) = -9x - 4$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$4x^2$	$-3x$	7
$-9x$	$-36x^3$	$27x^2$	$-63x$
-4	$-16x^2$	$12x$	-28

$$a(x) \cdot b(x) = -36x^3 + 27x^2 - 16x^2 - 63x + 12x - 28$$

Combine like terms.

$$a(x) \cdot b(x) = -36x^3 + 11x^2 - 51x - 28$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 105)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= x^3 - 8x^2 + x - 11 \\ g(x) &= x - 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	1	-8	1	-11
8		8	0	8
	1	0	1	-3

So,

$$\frac{f(x)}{g(x)} = x^2 + 1 + \frac{-3}{x-8}$$

In other words, $h(x) = x^2 + 1$ and the remainder is $R = -3$.

5. Let polynomial $f(x)$ still be defined as $f(x) = x^3 - 8x^2 + x - 11$. Evaluate $f(8)$.

You could do this the hard way.

$$\begin{aligned} f(8) &= (1)\cdot(8)^3 \ + \ (-8)\cdot(8)^2 \ + \ (1)\cdot(8) \ + \ (-11) \\ &= (1)\cdot(512) \ + \ (-8)\cdot(64) \ + \ (1)\cdot(8) \ + \ (-11) \\ &= (512) \ + \ (-512) \ + \ (8) \ + \ (-11) \\ &= -3 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(8)$ equals the remainder when $f(x)$ is divided by $x - 8$. Thus, $f(8) = -3$.